We claim:

1. A method for providing a hydrogen separation membrane 6upon a substrate, comprising;

providing a substrate having at least one surface; and

disposing upon said at least one surface a composition and forming a leak-tight coating utilizing said composition, wherein said leak-tight coating provides permeance of hydrogen therethrough, thereby forming said hydrogen separation membrane 6upon said substrate.

2. The method of claim 1, wherein said forming step utilizes a laser direct-write process.

3. The method of claim 1, wherein said composition providing said leak-tight coating is comprised of at least one of palladium or palladium alloy.

4. The method of claim 1, wherein said substrate is a porous substrate.

5. The method of claim 1, further comprising the step of subjecting said at least one surface to a surface treatment prior to disposing said composition upon said at least one surface.

6. The method of claim 5, wherein said surface treatment includes a polishing step.

7. The method of claim 6, further comprising the step of providing a diffusion barrier upon said substrate.

8. The method of claim 5, further comprising the step of providing a diffusion barrier upon said at least one surface after subjecting said at least one surface to said surface treatment.

9. The method of claim 8, further comprising the step of etching said provided diffusion barrier prior to disposing said composition upon said at least one surface

10. The method of claim 6, wherein said polishing step utilizes a method selected from the group consisting of shot peening, ion-beam treatment, plasma deposition of metals and vapor deposition of metals.

11. The method of claim 3, wherein said porous substrate is a porous metallic substrate.

12. The method of claim 9, wherein said etching step employs etching with at least one of nitric acid, hydrochloric acid and pickling solutions.

13. The method of claim 1, further comprising the step of subjecting said leak-tight coating to thermal processing.

14. The method of claim 13, wherein said steps of disposing, forming and thermally processing are successively repeated providing a plurality of layers of said leak-tight-coating, whereby said hydrogen separation membrane includes said plurality of layers.

15. The method of claim 13 or 14, wherein said thermal processing includes at least one of sintering and bake out of organics.

16. The method of claim 1, wherein said leak-tight coating providing said hydrogen separation membrane, disposed upon said substrate, is less than about 20 microns thick.

17. The method of claim 1, wherein said leak-tight coating providing said hydrogen separation membrane, disposed upon said substrate, is about 2 to about 10 microns thick.

18. The method of claim 1, wherein said leak-tight coating providing said hydrogen separation membrane, disposed upon said substrate, is about 5 to about 10 microns thick.

19. The method of claim 1, wherein said composition is a metallic ink having a metallic component and a carrier component.

20. The method of claim 19, wherein said metallic component of said metallic ink contains at least palladium.

21. The method of claim 19, wherein said metallic component of said metallic ink is produced by an aerosol decomposition process.

22. The method of claim 20, wherein said metallic component has a palladium content of about 70 to about 78%.

23. The method of claim 20, wherein said metallic component has a palladium content of about 75 to 77%.

24. The method of claim 20, wherein said metallic component is further comprised of silver.

25. The method of claim 24, wherein said metallic component of said metallic ink comprises about 25% palladium and silver mix and about 75% carrier, by weight respectively, wherein said palladium and silver mix is provided in a ratio of about 75% palladium to about 25% silver.

26. The method of claim 24, wherein said metallic component of said metallic ink comprises about 5% to 50% palladium and silver mix and about 50% to 95% carrier, by weight respectively, wherein said palladium and silver mix is provided in a ratio of about 70% to 78% palladium to about 22% to 30% silver.

27. The method of claim 15, wherein said thermal processing is carried out in an atmosphere having low partial pressure of oxygen.

28. The method of claim 15, wherein said thermal processing is carried out in a lean hydrogen gas atmosphere having less than about 10% hydrogen.

29. A membrane reformer comprising:

a thin leak-tight coating disposed upon a substrate, wherein said leak-tight coating transports hydrogen and said thin leak-tight coating is comprised of at least one of palladium, palladium alloys or palladium and silver alloy.

30. The reformer of claim 29, wherein said thin leak-tight coating is formed on a porous substrate.

31. The reformer of claim 30, wherein said substrate is a porous metal substrates.

32. The reformer of claim 31, wherein said thin leak-tight coating is formed on a porous metal substrate that has been polished.

33. The reformer of claim 32, wherein said polished substrate is treated to include a diffusion barrier between said polished substrate and said leak-tight coating.

34. The reformer of claim 33, wherein said diffusion barrier is etched.

35. The reformer of claim 32, wherein said polishing is accomplished by at least one of shot peening, ion-beam treatment, plasma deposition of metals and vapor deposition of metals.

36. The reformer of claim 29, wherein said thin leak-tight coating is provided by a laser direct-write process.

37. The reformer of claim 29, wherein said thin leak-tight coating has a thickness of less than about 20 microns.

38. The reformer of claim 29, wherein said thin leak-tight coating has a thickness of between about 2 to 10 microns.

39. The reformer of claim 29, wherein said thin leak-tight coating is formed utilizing a metallic ink having a metallic component and a carrier component.

40. The reformer of claim 39, wherein said metallic component of said metallic ink is provided by an aerosol decomposition process.

41. The reformer of claim 39, wherein said metallic component of said ink is comprised of an alloy having between about 70 to about 78% palladium.

42. The reformer of claim 39, wherein said metallic component of said ink is comprised of an alloy having between about 75 to about 77% palladium.

43. The reformer of claim 39, wherein said metallic component of said metallic ink is an alloy of palladium.

44. The reformer of claim 43, wherein said alloy includes silver.

45. The reformer of claim 44, wherein said metallic component of said metallic ink is comprised of about 25% palladium and silver mix and about 75% carrier, by weight respectively, wherein said palladium and silver mix is provided in a ratio of about 75% palladium to about 25% silver.

46. The reformer of claim 44, wherein said metallic component of said metallic ink is comprised of about 50% palladium and silver mix and about 50% carrier, by weight respectively, wherein said palladium and silver mix is provided in a ratio of about 70% palladium to about 30% silver.

47. The method of claim 13 or 14, wherein said thermal processing includes at least one of organics bake out and localized sintering of the coating and not an underlying support, wherein said localized sintering of the coating utilizes an ion or laser beam

48. The method of claim 2, wherein said substrate is cylindrical or tubular.

49. The reformer of claim 36, wherein said reformer wherein said substrate is cylindrical or tubular.